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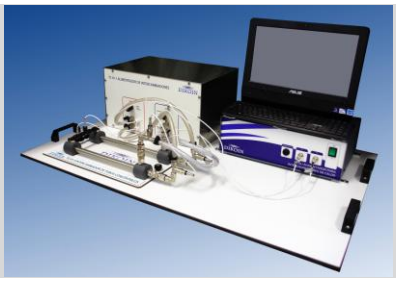

TC 01.1 - HEAT EXCHANGER SUPPLY UNIT (pag. F - 2)

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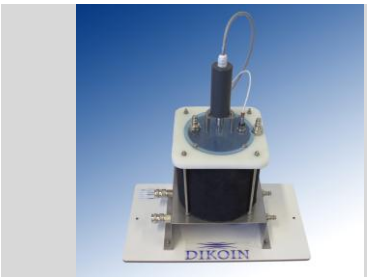

TC 01.5 - DOUBLE JACKETED VESSEL AND COIL HEAT EXCHANGER (pag. F - 3)

TC 02.1 - WATER COOLING TOWER UNIT (pag. F - 3)

TC 02.2 - TYPE A COOLING COLUMN (pag. F - 4)

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AC 03.1 - HEAT PUMP DEMONSTRATION

The AC 03.1 equipment demonstrates clearly the operation of a heat pump air / water.

The system consists of: compressor, circulating pump, flow control valve, storage tank, condenser, filter / drier, expansion valve and evaporator fan, water flow meters, temperature sensors and pressure displays at strategic points circuit.

With this complete teaching unit, it can be studied with clarity the use of environmental energy to heat water.

The refrigerant absorbs ambient heat when passing through the evaporator with a fan, and subsequently transferred to the water in the condenser.

The hot water storage tank is equipped with an internal heat exchanger, which can be connected to the network, to exchange energy with the flow of water.

The heat absorbed by the water in the condenser, turn to hot water tank, where the heat energy can be exchanged with the flow of water.

The system is also ready to operate in open circuit, ie the mains water can enter directly to the condenser, which have instantaneous heating.

IT 03.2 - NATURAL AND FORCED CONVECTION HEAT TRANSFER

IT 03.2 Equipment, is a very useful desktop for the study of heat transfer by natural or forced convection.

Equipment operation involves passing air through a duct, which is heated using calefactant elements with different geometric surfaces, for the study of forced convection fan is inserted.

The equipment is supplied with a computer.

RF 01.1 - COOLING CHAMBER

With this equipment, the industrial refrigeration phenomena is studied and visualized. It integrates all the essential components that a installation has in a bench top equipment. It is built with modular systems, and prepared for a freezing temperatures until -30ºC.

The equipment consists of a refrigeration chamber with a forced flow evaporator, thermostatic expansion valve and a 250 W condenser unit. Transparent and heated access panel. Cooling circuit with refrigerant flow display, and with heat exchanger for the under cooling of the liquid and solenoid valve. Electric defrost system and control through programmable PLC y function timer. Filter-dryer and liquid tank.

The use of independent controllers to control de equipment allows to simulate different faults on the operation. The "liquid anti-shock" system on the compressor ensures a reliable operation under extreme requests. The steam overheating can be regulated through the thermostatic valve adjustments.

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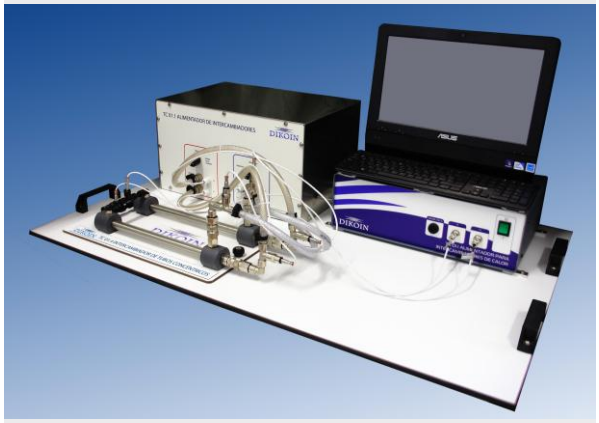
TC 01.1 - HEAT EXCHANGER SUPPLY UNIT



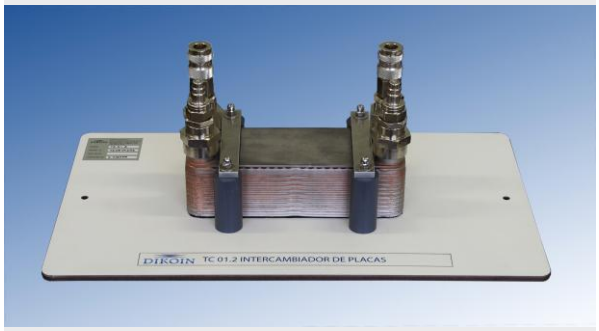
The TC 01.1 equipment is the core of the whole heat exchange TC 01 is the module that provides hot and cold water to the heat exchangers, in addition to measuring the temperatures and flow rates in each element.

All device connections are self-sealants, quick connectors that allow quick and simple change of different exchangers without loss of fluid. Connections for hot and cold water are different to avoid misunderstandings in the connection.

The module has a tank for hot water 4,5 litre capacity, temperature controllers and electronic level. An electromechanical valve fills the tank automatically when needed. The water storage system is protected against overheating, low water level and overflow tank.

The pumping system has a bypass, which facilitates the running of the pump, and allowing for better stabilization of the conditions in the tank.

TC 01.2 - PLATE HEAT EXCHANGER



In the plate heat exchanger, the hot and cold flows alternating sides pass through the gaps left by the plates, thus resulting in heat transfer.

The advantage of this type of heat exchanger is a compact configuration, and therefore are suitably used in confined spaces.

The plates have a geometry that causes a turbulence in the fluid, improving heat transfer.

TC 01.3 - SHELL TUBE HEAT EXCHANGER

The beam exchanger tubes is one of the most used in industry exchangers.

In this exchanger, the cold fluid passes through a series of parallel tubes grouped, and the heated fluid through the chamber containing small, thus resulting in heat transfer.

The advantage of this type of heat exchanger is a compact design and the ability to work at higher pressures than other designs.

This exchanger can operate with co-current or countercurrent flows.

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TC 01.4 - TUBULAR HEAT EXCHANGER

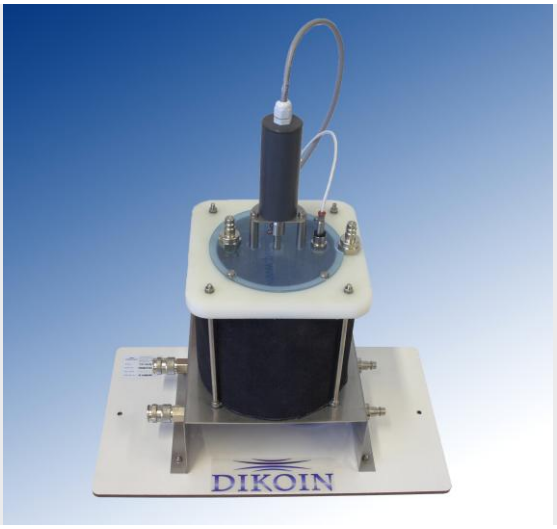
The heat exchanger of concentric tubes is simpler in design.

There are two parallel tubes through which cold fluid passes, inside which there is another pipe of smaller diameter by passing the heated fluid, thereby producing heat transfer. The advantage of this exchanger is its simple design.

The exchanger is arranged in two halves, and has incorporated thermocouples at midpoints, so as to significantly improve the learning experiment, because you can clearly see the change in temperature over the heat exchanger.

This exchanger can operate with co-current or countercurrent flows.

TC 01.5 - DOUBLE JACKETED VESSEL AND COIL HEAT EXCHANGER



This type of exchanger is usually used in the quimic and process industry, when a very well adjusted temperature is needed.

The exchanger can work with the vessel, or with the coil, and also there is the possibility to work with a continuous flow in the vessel, os heat a defined quantity of water.

The exchanger has also a temperature sensor which measures continuously the fluid temperature into the vessel, as well as a variable speed mixer, to study the differences on heat exchange.

TC 02.1 - WATER COOLING TOWER UNIT

The TC 02.1 unit, displays a standard cooling method used in the industry. This method involves cooling the hot water to environment temperature.

To do this, air is introduced at environment temperature by the bottom of the tower by a fan. Meanwhile, the system pulverizes the hot water in the upper side of the tower, this water is cooled until environment temperature is achieved, then reheated and again begins the process.

The unit is supplied with a computer. The computer already has installed the software.

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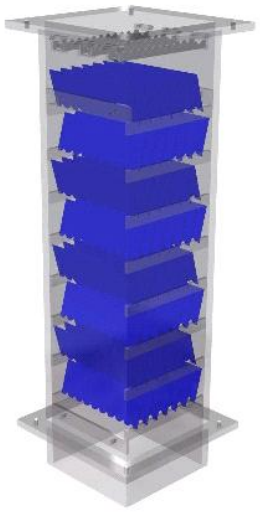
TC 02.2 - TYPE A COOLING COLUMN

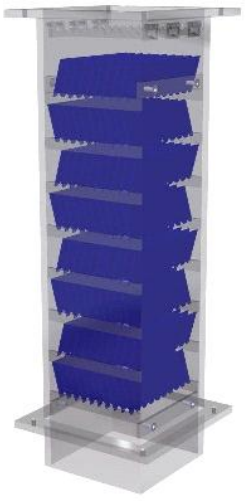
The A 02.2 tower type, is presented as an empty tower without wetting surfaces.

TC 02.3 - TYPE B COOLING COLUMN



The B TC 02.3 tower type, is presented as a tower of 8 levels and 7 panels per level.

TC 02.4 - TYPE C COOLING COLUMN



The C TC 02.4 tower type , is presented as a tower of 8 levels and 10 panels per level.

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TC 02.5 - TYPE D COOLING COLUMN

The D TC 02.5 tower type, is presented as a tower of 8 levels and 19 panels per level.

TC 02.6 - TYPE E COOLING COLUMN

The tower E TC 02.6 type, is presented as an 8-level tower and 19 panels per level, with temperature sensors at 3 points.

The sensors are:

- 7 dry bulb temperature sensors.
- 7 wet bulb temperature sensors.
- 3 water temperature sensors.

TD 01.1 - INTERNAL COMBUSTION ENGINE BENCH

The TD 01.1 equipment, has been designed for the study and understanding of the behavior of a gasoline four-stroke combustion engine.

With this equipment, the necessary tests can be carried out to obtain the data characteristic of the engine operation, thus familiarizing the students with the curves presented by the manufacturers of the same as a sample of their operation.

The internal combustion engine bench, has two engines, the engine to be tested, and therefore acts as such, in our case a four-stroke gasoline engine, and the braking system, which is constituted by a three-phase asynchronous engine controlled by a frequency inverter. The latter can function as both engine and generator.

COMPUTERIZED SYSTEM:
The Engine Test Bench (TD 01.1) is equipped with a complete computer system, which greatly streamlines the work of tests or practices.
The system is able to control and register all the variables of the equipment.
The tests can be done manually or automatically, just indicate the required variables and indicate how many points we want the graph of results. This way you do not waste time in aiming results and drawing the graphs by hand.

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TD 01.2 - DIESEL MOTOR ENGINE BENCH

Equipment designed for the study and understanding of the behavior of a four-stroke single cylinder diesel combustion engine.

The necessary tests can be carried out to obtain the data characteristic of the motor operation, familiarizing students with the curves presented by the manufacturers of the same as a sample of their operation.

The test bench for combustion engines has two motors, the motor to be tested, and therefore acts as such, and the braking system, which consists of a three-phase asynchronous motor controlled by a frequency inverter. The can function as both engine and generator.

COMPUTERIZED SYSTEM:

The Engine Test Bench (TD 01.2) is equipped with a complete computer system, which significantly streamlines the work of tests or practices.
The system is able to control and register all the variables of the equipment.
The tests can be done manually or automatically, just indicating the required variables and indicate how many points we want the graph of results. This way you do not waste time in aiming results and drawing the graphs by hand.

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